1. Do circled problems first. (Do all circles)
2. After you're done with the ○, do the □ problems second.

MATHEMATICS TEST

60 Minutes—60 Questions

DIRECTIONS: Solve each problem, choose the correct answer, and then darken the corresponding oval on your answer sheet.

Do not linger over problems that take too much time. Solve as many as you can; then return to the others in the time you have left for this test.

You are permitted to use a calculator on this test. You may use your calculator for any problems you choose, but some of the problems may best be done without using a calculator.

Note: Unless otherwise stated, all of the following should be assumed:

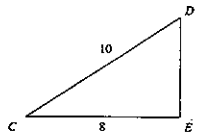
1. Illustrative figures are NOT necessarily drawn to scale.
2. Geometric figures lie in a plane.
3. The word *line* indicates a straight line.
4. The word *average* indicates arithmetic mean.

DO YOUR FIGURING HERE.

1. Point X is located at -15 on the real number line. If point Y is located at -11, what is the midpoint of line segment XY?

   A. -13
   B. -4
   C. -2
   D. 2
   E. 13

2. Given triangle CDE (shown below) with a right angle at E, what is the length of leg DE?



   F. $\sqrt{2}$
   G. 2
   H. 6
   J. $\sqrt{164}$
   K. 16

3. Lucy is studying her ant farm. She needs to approximate the number of ants in the population, and she realizes that the number of ants, N, is close to 50 more than double the volume of the ant farm, V. Which of the formulas below expresses that approximation?

   A. $N \approx \frac{1}{2}V + 50$
   B. $N \approx \frac{1}{2}(V + 50)$
   C. $N \approx 2V + 50$
   D. $N \approx 2(V + 50)$
   E. $N \approx V^2 + 50$

GO ON TO THE NEXT PAGE.

DO YOUR FIGURING HERE.

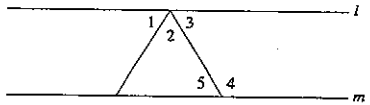
4. Lisa has 5 fiction books and 7 nonfiction books on a table by her front door. As she rushes out the door one day, she takes a book at random. What is the probability that the book she takes is fiction?

   F. $\frac{1}{5}$
   G. $\frac{5}{7}$
   H. $\frac{1}{12}$
   J. $\frac{5}{12}$
   K. $\frac{7}{12}$

5. In the spring semester of her math class, Katie's test scores were 108, 81, 79, 99, 85, and 82. What was her average test score in the spring semester?

   A. 534
   B. 108
   C. 89
   D. 84
   E. 80

6. Given parallel lines l and m, which of the following choices lists a pair of angles that must be congruent?



   F. $\angle 1$ and $\angle 2$
   G. $\angle 1$ and $\angle 3$
   H. $\angle 2$ and $\angle 3$
   J. $\angle 2$ and $\angle 5$
   K. $\angle 3$ and $\angle 5$

7. Gregor works as a political intern and receives a monthly paycheck. He spends 20% of his paycheck on rent and deposits the remainder into a savings account. If his deposit is $3,200, how much does he receive as his monthly pay?

   A. $ 4,000
   B. $ 5,760
   C. $ 7,200
   D. $ 8,000
   E. $17,000

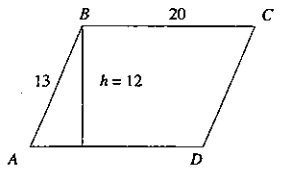
GO ON TO THE NEXT PAGE.

○ Circled first!
□ Square second.
If time, complete the remaining problems.

Name _____

Date _____ Block _____

8. Given parallelogram *ABCD* below and parallelogram *EFGH* (not shown) are similar, which of the following statements must be true about the two shapes?



F. Their areas are equal.
G. Their perimeters are equal.
H. Side *AB* is congruent to side *EF*.
J. Diagonal *AC* is congruent to diagonal *EG*.
K. Their corresponding angles are congruent.

DO YOUR FIGURING HERE.

9. A size 8 dress that usually sells for $60 is on sale for 30% off. Victoria has a store credit card that entitles her to an additional 10% off the reduced price of any item in the store. Excluding sales tax, what is the price Victoria pays for the dress?

A. $22.20
B. $24.75
C. $34.00
D. $36.00
E. $37.80

10. Erin and Amy are playing poker. At a certain point in the game, Erin has 3 more chips than Amy. On the next hand, Erin wins 4 chips from Amy. Now how many more chips does Erin have than Amy?

F. 1
G. 1
H. 7
J. 11
K. 14

GO ON TO THE NEXT PAGE.

DO YOUR FIGURING HERE.

11. If $y = 4$, what does $|1 - y| = ?$

A. −5
B. −3
C. 3
D. 4
E. 5

12. $(3a + 2b)(a - b^2)$ is equivalent to:

F. $4a + b^2$
G. $3a^2 - 2b^3$
H. $3a^2 + 2ab + 2b^3$
J. $3a^2 - 3ab^2 + a^2b^2$
K. $3a^2 - 3ab^2 + 2ab - 2b^3$

13. For all real values of y, $3 - 2(4 - y) = ?$

A. $-2y - 9$
B. $-2y + 8$
C. $-2y - 1$
D. $2y - 5$
E. $2y + 11$

14. What does $(y^3)^8 = ?$

F. y^{11}
G. y^{24}
H. $8y^3$
J. $8y^{11}$
K. $24y$

GO ON TO THE NEXT PAGE.

15. If the first day of the year is a Monday, what is the 260th day?

A. Monday
B. Tuesday
C. Wednesday
D. Thursday
E. Friday

DO YOUR FIGURING HERE.

16. If a square has an area of 64 square units, what is the area of the largest circle that can be inscribed inside the square?

F. 4π
G. 8π
H. 16π
J. 64
K. 64π

17. What is the product of the solutions of the expression $x^2 - 5x - 14 = 0$?

A. −14
B. −2
C. 0
D. 5
E. 7

18. Factoring the polynomial $x^{12} - 9$ reveals a number of factors for the expression. Which of these is NOT one of the possible factors?

F. $x^6 + 3$
G. $x^{12} - 9$
H. $x^3 + \sqrt{3}$
J. $x^3 - \sqrt{3}$
K. $x - \sqrt{3}$

GO ON TO THE NEXT PAGE.

19. What is the value of $\frac{2x+4}{3x}$ when $x = \frac{1}{6}$?

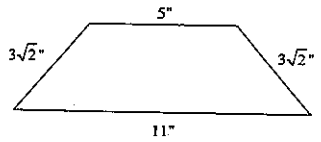
A. $4\frac{1}{3}$
B. 2
C. $\frac{26}{3}$
D. 12
E. 24

DO YOUR FIGURING HERE.

20. If you drive 60 miles at 90 miles an hour, how many minutes will the trip take you?

F. 15
G. 30
H. 40
J. 60
K. 90

21. The area of a trapezoid is found by multiplying the height by the average of the bases: $A = \frac{1}{2}h(b_1 + b_2)$. Given the side measurements below, what is the area, in square inches, of the trapezoid?



A. $15\sqrt{2}$
B. 22
C. 24
D. $24\sqrt{2}$
E. $30\sqrt{2}$

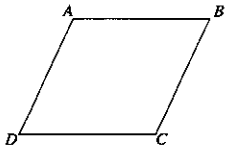
GO ON TO THE NEXT PAGE.

DO YOUR FIGURING HERE.

22. If $x = -\frac{2}{3}$ and $x = \frac{1}{4}$ are the roots of the quadratic equation $ax^2 + bx + c = 0$, then which of the following could represent the two factors of $ax^2 + bx + c$?

F. $(3x + 2)$ and $(4x - 1)$
G. $(3x + 1)$ and $(4x - 2)$
H. $(3x - 1)$ and $(4x + 2)$
J. $(3x - 2)$ and $(4x + 1)$
K. $(3x - 2)$ and $(4x - 1)$

23. In the rhombus below, diagonal $AC = 6$ and diagonal $BD = 8$. What is the length of each of the four sides?



A. $\sqrt{7}$
B. $\sqrt{14}$
C. 5
D. 7
E. 10

24. A rectangular rug has an area of 80 square feet, and its width is exactly 2 feet shorter than its length. What is the length, in feet, of the rug?

F. 8
G. 10
H. 16
J. 18
K. 36

GO ON TO THE NEXT PAGE.

DO YOUR FIGURING HERE.

25. In the Cartesian plane, a line runs through points $(1,-5)$ and $(5,10)$. Which of the following represents the slope of that line?

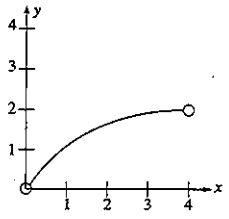
A. $\frac{4}{15}$
B. $\frac{4}{5}$
C. 1
D. $\frac{5}{4}$
E. $\frac{15}{4}$

26. The equation of a circle in the standard (x,y) *coordinate plane is given by the equation* $(x + 5)^2 + (y - 5)^2 = 5$. What is the center of the circle?

F. $(-\sqrt{5}, \sqrt{5})$
G. $(-5, 5)$
H. $(\sqrt{5}, -\sqrt{5})$
J. $(5, -5)$
K. $(5, 5)$

27. The graph below shows a function, $f(x)$, in the coordinate plane. Which of the following choices best describes the *domain* of this function?

(Note: The domain is defined as the set of all values of x for which a function is defined.)



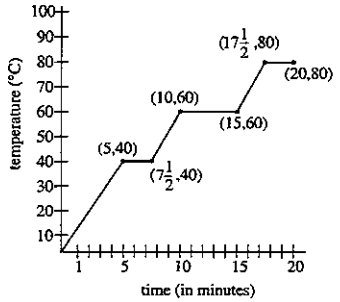
A. $\{0, 1, 2, 3, 4\}$
B. $\{0, 1, 2\}$
C. $\{x: 0 < x < 2\}$
D. $\{x: 0 < x < 4\}$
E. All real values of x

GO ON TO THE NEXT PAGE.

28. Amber decides to graph her office and the nearest coffee shop in the standard (x,y) plane. If her office is at point (–1,–5) and the coffee shop is at point (3,3), what are the coordinates of the point exactly halfway between those of her office and the shop? (You may assume Amber is able to walk a straight line between.)

F. (1, –1)
G. (1, 4)
H. (2, –1)
J. (2, 4)
K. (2, 0)

29. For a chemistry class, Sanjay is doing an experiment that involves periodically heating a container of liquid. The graph below shows the temperature of the liquid at different times during the experiment. What is the average rate of change of temperature (in degrees Celsius per minute) during the times in which Sanjay is applying heat to this container?



A. 4
B. 5
C. 8
D. 10
E. 20

30. If $\frac{a^x}{a^y} = a^5$, for $a \neq 0$, which of the following statements must be true?

F. $x \neq 0$ and $y \neq 0$

G. $x + y = 5$

H. $x - y = 5$

J. $xy = 5$

K. $\frac{x}{y} = 5$

DO YOUR FIGURING HERE.

GO ON TO THE NEXT PAGE.

31. What is the slope of the line given by the equation $8 = 3y - 5x$?

A. –5
B. $-\frac{5}{3}$
C. $-\frac{3}{5}$
D. $\frac{3}{5}$
E. $\frac{5}{3}$

32. When adding fractions, a useful first step is to find the least common denominator (LCD) of the fractions. What is the LCD for these fractions?

$$\frac{2}{3^2 \cdot 5}, \frac{13}{5^2 \cdot 7 \cdot 11}, \frac{2}{3 \cdot 11^3}$$

F. $3 \cdot 5 \cdot 7 \cdot 11$
G. $3^2 \cdot 5^2 \cdot 7 \cdot 11$
H. $3^2 \cdot 5^2 \cdot 11^3$
J. $3^2 \cdot 5^2 \cdot 7 \cdot 11^3$
K. $3^3 \cdot 5^3 \cdot 7 \cdot 11^4$

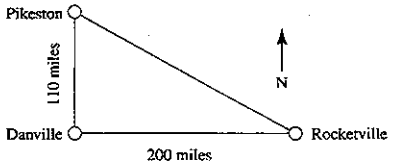
33. $\frac{1}{4} \cdot \frac{2}{5} \cdot \frac{3}{6} \cdot \frac{4}{7} \cdot \frac{5}{8} \cdot \frac{6}{9} \cdot \frac{7}{10} = ?$

A. $\frac{1}{720}$
B. $\frac{1}{360}$
C. $\frac{1}{120}$
D. $\frac{27}{49}$
E. 1

DO YOUR FIGURING HERE.

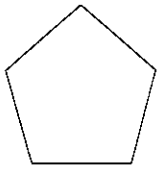
GO ON TO THE NEXT PAGE.

34. Dave is in Pikeston and needs to go to Danville, which is about 110 miles due south of Pikeston. From Danville, he'll head east to Rocketville, about 200 miles from Danville. As he sets out on his trip, a plane takes off from the Pikeston airport and flies directly to Rocketville. Approximately how far, in miles, does the plane fly?



F. 310
G. $\sqrt{310}$
H. $\sqrt{27900}$
J. $\sqrt{30000}$
K. $\sqrt{52100}$

35. The figure below is a pentagon (5-sided figure). Suppose a second pentagon were overlaid on this pentagon. At most, the two figures could have how many points of intersection?



A. 1
B. 2
C. 5
D. 10
E. Infinitely many

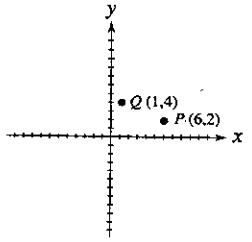
36. MicroCorp will hold its annual company picnic next week and will assign 3 planning duties to its employees. One person selected will reserve a venue, another will arrange catering, and a third will plan activities. There are 10 employees eligible to fulfill these duties, and no employee can be assigned more than one duty. How many different ways are there for duties to be assigned to employees?

F. 7^3
G. 9^3
H. 10^3
J. $9 \cdot 8 \cdot 7$
K. $10 \cdot 9 \cdot 8$

DO YOUR FIGURING HERE.

GO ON TO THE NEXT PAGE.

37. In the (x,y)coordinate plane below, points $P(6,2)$ and $Q(1,4)$ are two vertices of ΔPQR. If $\angle PQR$ is a right angle, then which of the following could be the coordinates of R?



A. (4,−3)
B. (3, 0)
C. (2, 1)
D. (2, 4)
E. (3, 9)

38. If $y = 0.25(100 - y)$, then what is the value of y?

F. 200
G. 75
H. 25
J. 20
K. 18

39. If $0° \leq x° \leq 180°$ and $4\cos^2 x = 1$, then $x° = ?$

A. 0°
B. 60°
C. 90°
D. 150°
E. 180°

40. Danielle's living room is a rectangle with the dimensions 16 feet by 18 feet. If she partially covers the bare floor with a circular throw rug with a diameter of 12 feet, what is the approximate area of bare floor, in square feet, that remains exposed?

(Note: Assume the rug lies completely flat and does not touch any wall.)

F. 113
G. 144
H. 175
J. 288
K. Cannot be determined without knowing the exact position of the rug

DO YOUR FIGURING HERE.

GO ON TO THE NEXT PAGE.

DO YOUR FIGURING HERE.

41. In the standard (x,y) coordinate plane, which of the following is the equation of the line perpendicular to the line $y = -2x + 2$ and that passes through the point $(0,-3)$?

A. $y = -2x - 3$

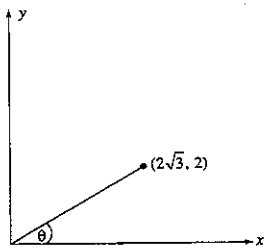
B. $y = -\frac{1}{2}x + 2$

C. $y = \frac{1}{2}x - 3$

D. $y = \frac{1}{2}x + 2$

E. $y = 2x - 3$

42. In the figure given below, what is $\sin \theta$?



F. $\frac{1}{2}$

G. $\frac{\sqrt{3}}{3}$

H. $\frac{\sqrt{3}}{2}$

J. 1

K. $\sqrt{3}$

43. If $a = 5$ and $b = -\frac{1}{4}$, which of the following expressions will be the greatest?

A. $a + b$
B. $a - b$
C. $a \times b$
D. $a \div b$
E. $|a \times b|$

GO ON TO THE NEXT PAGE.

DO YOUR FIGURING HERE.

44. When $\frac{x}{3} - 1 = -\frac{13}{12}$, which of the following must be true?

F. $-12 < x < -3$
G. $-3 < x < 0$
H. $0 < x < 3$
J. $3 < x < 4$
K. $4 < x$

45. Which choice below is the complete solution set of $|2z - 3| \geq 7$?

A. $z \geq 5$
B. $z \leq -2$ or $z \geq 5$
C. $-5 \leq z \leq 5$
D. $z \leq -6$ or $z \geq 2$
E. $z \leq -5$ or $z \geq 2$

46. Which trigonometric function (where defined) is equivalent to $\frac{\sin^2 x}{\cos x \tan x}$?

F. $\frac{\cos x}{\sin^2 x}$

G. $\frac{1}{\cos x}$

H. $\sin x$

J. $\frac{1}{\sin x}$

K. $\frac{1}{\sin^2 x}$

GO ON TO THE NEXT PAGE.

DO YOUR FIGURING HERE.

47. When $a \neq b$, the expression $\frac{ax - bx}{4a - 4b} < 0$. Which of the following describes the complete set of x values that make this inequality true?

A. $x = -4$ only

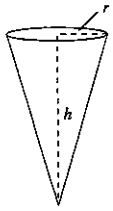
B. $x = 4$ only

C. $x = -\frac{1}{4}$ only

D. $x < 0$

E. $x > 0$

48. The volume of a cone, which is derived by treating it as a pyramid with infinitely many lateral faces, is given by the formula $V = \frac{1}{3}\pi r^2 h$, where r is the radius of the base and h is the height. If the radius is halved and the height is doubled, what will be the ratio of the new volume to the old volume?



F. 4:1
G. 2:1
H. 1:1
J. 1:2
K. 1:4

49. Al bikes a trail to the top of a hill and back down. He bikes up the hill in m minutes, then returns twice as quickly downhill on the same trail. What is the total time, in hours, that Al spends biking up the hill and back down?

A. $\frac{m}{60}$

B. $\frac{m}{40}$

C. $\frac{m}{30}$

D. $\frac{3m}{2}$

E. $2m$

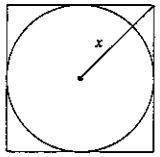
GO ON TO THE NEXT PAGE.

DO YOUR FIGURING HERE.

50. Pippin the guinea pig is running on her wheel when, due to a manufacturing error, the wheel breaks free of its axis. Pippin remains in her wheel, running in a straight line until the wheel has rotated exactly 15 times. If the diameter of the wheel is 10 inches, how many inches has the wheel rolled?

F. 75
G. 150
H. 75π
J. 150π
K. $1{,}500\pi$

51. A circle is inscribed in a square, as shown below. If x is the distance from the center of the circle to a vertex of the square, then what is the length of the radius of the circle, in terms of x?



A. $2x$

B. $x\sqrt{2}$

C. x

D. $\frac{x\sqrt{2}}{2}$

E. Cannot be determined from the information given

52. A function is defined for x and y such that $f_{(x,y)} = -2xy + y + x - 4$. So, for $x = 2$ and $y = 3$, $f_{(2,3)} = -2 \times 2 \times 3 + 3 + 2 - 4 = -12 + 1 = -11$. If x and y are to be chosen such that $f_{(x,y)} = f_{(y,x)}$, then which of the following restrictions must be placed on x and y?

F. $x > 0$ and $y > 0$
G. $x < 0$ and $y < 0$
H. $x = y$
J. $xy < 0$
K. No restrictions are needed.

GO ON TO THE NEXT PAGE.